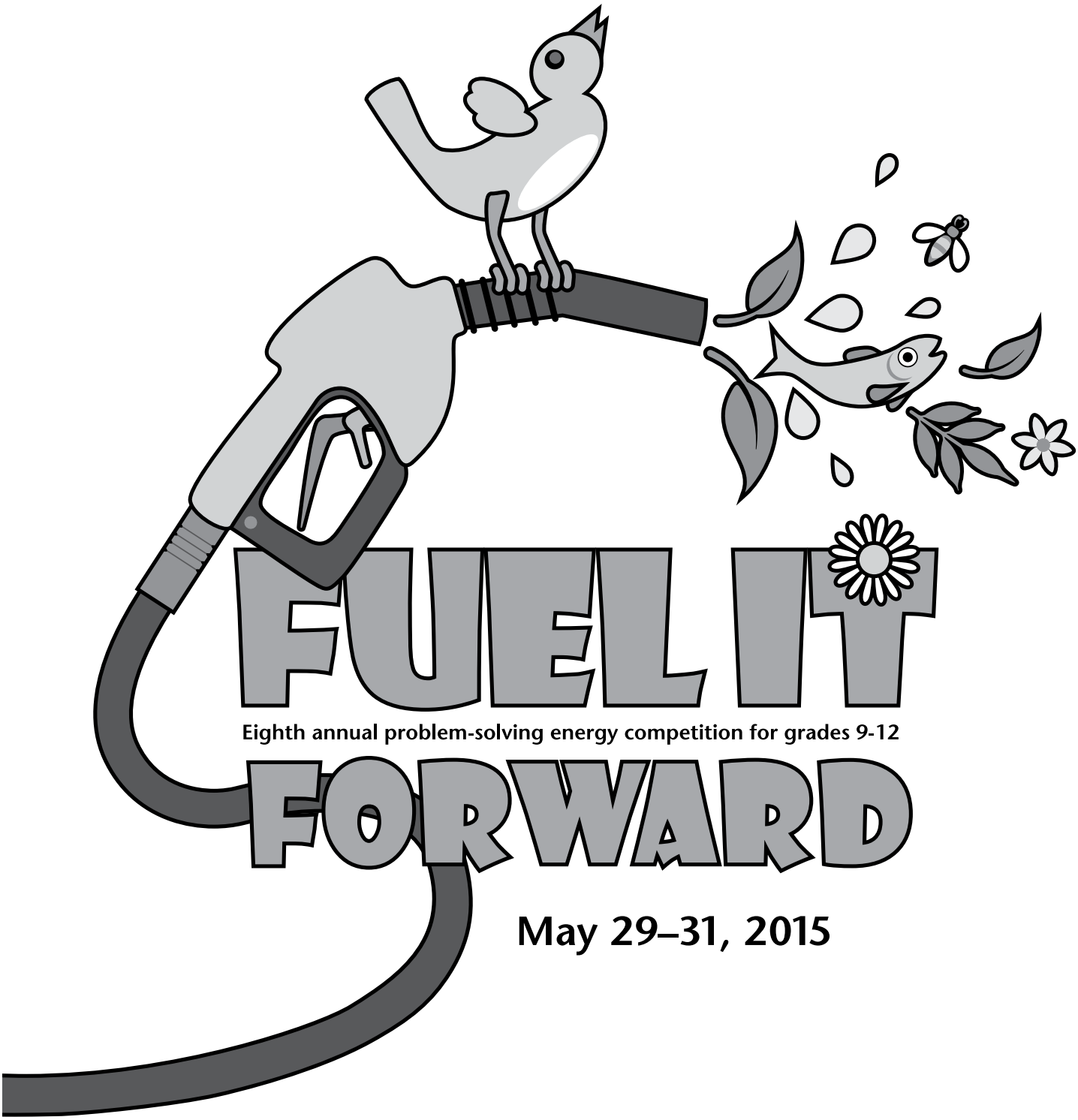
Imagine
TOMORROW



FUEL IT FORWARD

Eighth annual problem-solving energy competition for grades 9-12

May 29–31, 2015

WASHINGTON STATE UNIVERSITY

IMAGINE TOMORROW

THANKS OUR GENEROUS SUPPORTERS AND SALUTES THEIR VISION FOR THE FUTURE.

PREMIER SPONSORS

NARA
Northwest Advanced Renewables Alliance

USDA
United States Department of Agriculture

Imagine Tomorrow is an education initiative of the Northwest Advanced Renewables Alliance (NARA).

NARA is led by Washington State University and supported by the Agriculture and Food Research Initiative Competitive Grant no. 2011-68005-30416 from the USDA National Institute of Food and Agriculture.

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- Northwest Energy Efficiency Council (NEEC)
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- Shamish Patel
- SME Spokane Chapter 248
- Trane Climate Solutions

IMAGINE TOMORROW

EVENT SCHEDULE

FRIDAY, MAY 29, 2015

12:00 noon
Check in begins at Gannon-Goldsworthy residence hall

12 noon – 6:00 p.m.
Set up/assemble your projects
Compton Union Building (CUB) ballrooms, second floor

3:00 – 4:30 p.m.
Workshops and tours, beginning and ending at Gannon-Goldsworthy residence hall lobby

5:30 – 7:00 p.m.
Dinner at Southside Café

6:00 – 9:00 p.m.
Free time and activities at the Student Recreation Center
Come prepared for fun, with swimming, basketball, racquetball, fitness classes, and more! Keep in mind that the pool will close at 8:30 p.m., 30 minutes before the Student Recreation Center closes for the evening.

7:30 – 8:30 p.m.
Advisors meet with competition organizers
to review last-minute competition details
Student Recreation Center

9:00 p.m.
Return to residence halls

10:00 p.m.
Residence halls locked
11:00 p.m.
Lights out in residence halls

*Judges will visit displays and ask questions of students throughout the designated display hours: from 8:00 – 11:15 a.m. and from 1:00 – 3:00 p.m. There are no set presentation times, so there should be at least one student staffing the project display at all times during these hours. Teams should limit their presentations to a total of five minutes in length, including time used for PowerPoint presentations, films, or other formal presentation media.

SATURDAY, MAY 30, 2015

6:30 – 8:00 a.m.
Breakfast at Southside Café

7:00 – 7:45 a.m.
Set up/assemble projects
CUB ballrooms

7:30 – 8:00 a.m.
Advisors meet with Directors of Judging
CUB Auditorium

8:00 – 11:15 a.m.
Presentation and judging of displays*
CUB ballrooms

11:30 a.m. – 1:00 p.m.
Lunch at Southside Café

12:15 – 1:00 p.m.
View projects (no judging)
CUB ballrooms
Take advantage of this opportunity to see your fellow competitors' projects!

1:00 – 3:00 p.m.
Presentation and judging of displays*
CUB ballrooms

1:15 – 2:00 p.m.
Biofuels in the Pacific Northwest
Join members of the Northwest Advanced Renewables Alliance Education Team to learn about a PNW-based biofuels project and K12 educational resources related to bioenergy.
CUB Auditorium

3:00 – 4:00 p.m.
Ice cream social for students, judges, and sponsors
Enjoy WSU's famous Ferdinand's Ice Cream Grabbers
CUB Lair
Breakdown and removal of projects
CUB ballrooms

5:30 – 7:00 p.m.
Dinner at Southside Café

8:00 p.m.
Keynote address
and awards ceremony
CUB Senior Ballroom

11:00 p.m.
Residence halls locked

12:00 midnight
Lights out in residence halls

SUNDAY, MAY 31, 2015

6:30 – 8:00 a.m.
Breakfast at Southside Café

6:30 – 9:00 a.m.
Check out, Gannon-Goldsworthy residence hall lobby

HOW WOULD YOU IMAGINE TOMORROW?

Demand for clean energy, the threat of global warming, and the question of how to transition to an economy based on alternatives to fossil fuels are concerns for everyone. These tough issues demand focused research and a commitment that spans individuals, communities, governments, and industries. But the best solutions start with great ideas—like yours.

That's what *Imagine Tomorrow* is all about.

TOPIC

TODAY'S IDEAS. TOMORROW'S ENERGY.

High school teams explore ways to enable the transition to alternate energy sources.

FOUR CHALLENGES

CHALLENGE: BEHAVIOR

Consider the question of why people are resistant to adopting and implementing alternate sources of energy.

CHALLENGE: BIOFUELS

The range of biofuels being proposed for use in transportation ranges from ethanol to biodiesel, and the feedstocks that are used to create these fuels vary around the country. Demonstrate a technological, design, or behavioral aspect of how biofuels will be utilized in the U.S. or around the world.

CHALLENGE: DESIGN

Design a living/working space (a building, suburb, town, or city) that has significantly lower energy demand or energy-related emissions than at present.

CHALLENGE: TECHNOLOGY

Invent or redesign a machine or process that uses sustainable technologies for energy production, consumption, and conservation.

AWARDS

AWARDS FOR EACH OF THE FOUR CHALLENGES

1st $500 for each student team member,
$2,000 for their school

2nd $300 for each student team member,
$1,500 for their school

3rd $200 for each student team member,
$1,000 for their school

4th $100 for each student team member,
$500 for their school

AWARDS FOR NEWLY PARTICIPATING SCHOOLS

Up to 18 awards, one to a team from a newly participating school from each federal congressional district.

$100 for each student team member,
$500 for the school

OTHER AWARDS

- Innovative
- Likely to Succeed in the Marketplace
- Community Impact Award
- Global Impact Award
- Advisors' Favorite
- Exceptional Teamwork
- Inspirational


THE WORLD IS WHAT WE MAKE IT.
Every day, each one of us has an opportunity to make the world a better place. Congratulations to all of the Washington State University Imagine Tomorrow participants. We are proud to salute the next generation of innovators as they "fuel it forward" to build a better planet for us all.
BOEING

JAY INSLEE
Governor

STATE OF WASHINGTON
Office of the Governor

Greetings from the Governor

May 29 - 31, 2015

I am pleased to extend warm greetings to all of those participating in the 8th annual *Imagine Tomorrow* high school energy competition, hosted by Washington State University. For those of you who have traveled from Idaho, Montana and Oregon, it is a privilege to welcome you to the beautiful Evergreen State.

As a passionate advocate for clean energy technology, I am thrilled to see students engaging with STEM (science, technology, engineering and math) learning and applying it to real world challenges. After all, you are the future leaders of this state and country, and it is important that you understand the importance of promoting clean energy technology in order to address climate change and reduce our dependence on foreign oil.

Imagine Tomorrow is not just about tomorrow, however. It is also about *today*. It represents the kind of creative thinking and interdisciplinary problem-solving skills that are needed right now. As Washingtonians, innovation is in our genes, and we have the potential to lead the next wave of world-changing technological advances. Students, the work you're doing right now could be the beginning of your career path or perhaps even a catalyst for one of those new breakthroughs. I applaud each of you for stepping up and pushing yourself to the next level of excellence. You're thinking big and working hard, and I hope your energy and ingenuity will inspire your peers and your communities to embrace the need for a more sustainable future.

Good luck to each team, and please accept my best wishes for a memorable competition!

Very truly yours,

Jay Inslee
Governor

P.O. Box 40002 • Olympia, Washington 98504-0002 • (360) 902-4111 • www.governor.wa.gov

SUPERINTENDENT OF PUBLIC INSTRUCTION

Randy I. Dorn Old Capitol Building · PO BOX 47200 · Olympia, WA 98504-7200 · http://www.k12.wa.us

April 13, 2015

Dr. Elson S. Floyd, President
Washington State University
PO Box 641048
Pullman, WA 99164-1048

Dear Dr. Floyd:

It is with great enthusiasm that the Office of Superintendent of Public Instruction supports Washington State University's *Imagine Tomorrow* high school problem solving competition. *Imagine Tomorrow* offers students a unique and powerful opportunity to do real-world STEM learning, design energy and other sustainability-related solutions, and engage with professionals from across the state. This is the kind of 21st century learning we want all youth to experience.

Student achievement occurs when learning is personalized, rigorous, and relevant. Through *Imagine Tomorrow,* students draw upon knowledge from the sciences, humanities, business, engineering, and social studies. Working together, they can make a difference.

I am especially pleased that *Imagine Tomorrow* provides a rich learning experience directly connected to our recently adopted Washington State Science Learning Standards (NGSS) and our state environmental sustainability standards. Additionally, *Imagine Tomorrow* is an excellent way to further our state goal of preparing students to be college and career ready. Thank you for providing this opportunity for our students to participate actively in creating a sustainable future through meaningful academic experiences. I wish you and the students all the best!

Sincerely,

Randy I. Dorn
State Superintendent
of Public Instruction

COMPETITION ENTRIES

1 THE UTILIZATION OF PELTIER AND SEEBECK EFFECT TO INNOVATE THE LANDSCAPE OF RENEWABLE ENERGY GENERATION

Technology

How could we efficiently and effectively use Peltier tiles to collect heat from everyday appliances to create a viable source of electricity?

To conduct our experiment, we acquired 6 thermoelectric generating Peltier tiles, arranged them in a three-by-two arrangement, and wired them in series. To the face of the Peltier tiles, we attached aluminum heat sinks. The tiles were then placed on a temperature-regulated heating plate set to 100 degrees Celsius. A timer was set for 30 seconds, and the average voltage produced at the end of the 30-second period over three trials was recorded. We then repeated these steps for 125, 150, 175, and 200 degrees Celsius. Between each trial, the Peltier tiles will cool down to ambient room temperature to ensure consistency.

Camas High School, Camas, Washington

Raveena Bhui
Mikayla Canifax
Erik Johnson
Christine Lee

2 SOLAR PANEL CELL PHONE CHARGER

Design

Will flexible solar panel installations on the south-facing end of airport windows provide enough electrical energy to energize electrical devices?

We are making a model to display a solar panel charger that will charge a cell phone. We will then increase the scale to have a solar panel to charge cell phones in the Sea-Tac airport. We want to install a solar panel at the south end of the airport to allow travelers to charge their cell phones without using electricity while waiting for their flights.

Klahowya Secondary School, Silverdale, Washington

Mackenzee Brandt
Allison Burchett
Cailey Ferber
Spencer Morley-Short
Alison Morton

3 IMPLEMENTATION OF A CARBON-DIOXIDE-BASED REFRIGERATION SYSTEM AS COGENERATION APPLIANCE AND ALTERNATIVE FOR HALOCARBON-BASED REFRIGERATION SYSTEMS

Technology

How can we redesign domestic refrigeration systems to reduce dependency on powerful greenhouse gases such as halocarbon refrigerants?

Investigate how HFC-based domestic refrigeration systems work and quantify the performance of existing domestic refrigerators. Apply this knowledge to develop a new prototype utilizing CO_2 as the working chemical and analyze performance and environmental impact in relation to the original halocarbon-based refrigerator.

Tesla STEM High School, Redmond, Washington

Oisin Doherty
Sonia Murthy
Ethan Perrin
Sophia Tevosyan
Andrew Wang

4 ENGINEERING A NEW EFFICIENT METHOD TO ENCOURAGE PEOPLE TO RECYCLE VIA A COLOR CODING SYSTEM, THEREFORE SAVING EXPENDED ENERGY WASTED IN THE DISPOSAL OF GARBAGE

Behavior

How can we reduce the amount of energy expended through the burning of garbage by reducing the amount of recyclable materials that are thrown away?

Engineer a new recycling system based on color coding recycle bins and the corresponding recyclable materials in order to observe if the general public will naturally adopt and use the new system.

Academy of Construction and Engineering—Marysville Getchell High School, Marysville, Washington

Tyler Dukleth
Trey Lovold

5 ARDUINO WEATHER STATION

Technology

Can an Arduino-based weather station data logger system serve as a feasible alternative to current weather station systems?

Arduino-based systems were tested for input and output accuracy and precision, and their performance compared to that of a Campbell Scientific data logger.

Capital High School, Boise, Idaho

Ashley Hoop
Nick Sabaj

6 SAVING YOU MONEY, ONE STEP AT A TIME

Design

How can we create sustainable electricity using human movement?

First we did background research on piezoelectricity. We then created a stair-step model and placed piezoelectric disks on the step so that it creates electricity when force is applied.

TAF Academy, Kent, Washington

Alfred Ra'oof
Ruther Tagala
Tyler Tetzloff
Mahlet Tiruneh
Elizabeth VanTrease

7 CUPS EVERGREEN

Behavior

How can we eliminate the use of disposable cups in coffee shops?

We decided to hand out surveys to gather information on people's opinions about taxing disposable coffee cups. Fifty-four surveys have been completed and we will hand out more in the near future. We also talked to a behavioral therapist about reward vs. punishment, meaning what would happen if people brought a reusable cup or not. There have been projects like this in the past, but we wanted to focus more on the people and what they might want instead of convincing local coffee shops to do what we want. Based on the data we collected from our surveys, many people were in favor of taxing disposable cups. As we progress with this project, we want to start a petition for taxing disposable cups.

Ballard High School, Seattle, Washington

Rose Albrecht
Gianna Barbadillo
Grace Beimborn
Deepa Patel
Angelique White

8 SOLAR POWER PLUS

Technology

Can Fresnel lenses be used to increase the efficiency of passive solar panels?

We will run controlled experiments with two passive solar water heaters, one with Fresnel lenses installed over the panel to help concentrate the sun's rays and another without the lenses. Temperatures will be recorded on the inlets and outlets of both and compared.

Colville High School, Colville, Washington

Mark Shevchenko
Justus Trautman

9 INVESTIGATING THE PROPERTIES OF NAFION FOR LOW-ENERGY, COST-EFFECTIVE DESALINATION

Design

Does Nafion effectively desalinate water?

Put salt water through Nafion tubes with a set-up of our own design and see if filtration of salt happens.

Henry M. Jackson High School, Mill Creek, Washington

Yuepon Fan-Hernandez
Alexandra Souter

10 EXPANDING ENVIRONMENTAL AWARENESS IN OUR HISPANIC COMMUNITY

Behavior

How can we expand awareness in our Hispanic community using the three Rs?

In 2014 we educated Hispanic families about the 3 Rs (reduce, reuse, recycle) and documented their improvements. In 2015, we want to educate more families about the 3 Rs and also about other ways they can reduce their resource use. To broaden our reach, we plan to create an event in which we focus on children so they can spread the word with their parents and other adults. We plan to teach about the 3 Rs AND other topics like energy use and how it will benefit our community environmentally and economically.

Ellensburg High School, Ellensburg, Washington

Diana Baldovinos
Alexandra Hernandez
Viridiana Magana
Daisy Sanchez
Carmen Valera

11 THERMOREGULATION, ELECTROGENERATION, AND THE HUMAN CONDITION

Technology

Can we efficiently use the Peltier technology to transfer body heat into usable energy?

Our group decided to pursue the issue of energy availability and generation from a perspective that's rarely touched on. We will explore the heat normally wasted and generated by our bodies. To get people to be more conscious about this technology, we will generate electricity that can even be used with LED technology. We've designed clothing that can utilize the Peltier effect to generate electricity from body heat. It'll take energy that's already being wasted and not put to use and turn it into usable electricity that has infinite applications.

Henry Foss High School, Tacoma, Washington

Shawn Glenn
Nermala Krishna
Scot Nelson
Nicole Ripley

12 USING GRASS, NOT GAS—POWERING A LAWN MOWER USING CELLULOSIC ETHANOL

Biofuels

Can we make a lawn mower run off of ethanol that has been created from the grass it mows?

Our group's goal will be to design a lawn mower that will be powered by ethanol that is created from the grass it mows, creating a sustainable fuel loop. We will start by reducing the cellulose in mowed grass into glucose. The glucose will then be fermented into an ethanol solution and distilled to a higher concentration. Once distilled, the solution will then have all remaining impurities removed using molecular sieves. At this point, the lawnmower will be filled with the resulting E100 mix, and the carburetor will be adjusted to the point of optimal performance. We will measure our success by the concentration of ethanol achieved and the performance of the lawn mower.

Camas High School, Camas, Washington

Jeff Fadlovich
Adam Jensen
Thomas Kuzis
Anish Prasad

13 TESLA STEM EV CONVERSION

Technology

Can we design an affordable conversion (for a Mazda RX-7) while maintaining quality and comfort?

Learn how gas and electric vehicles work, see what has already been done, learn about parts, and create a design, acquire parts, and convert a car. We largely did immense amounts of detailed research to learn how we could convert a car, with no mentor whatsoever. To cover costs, we acquired sponsors and have done all deconstruction of the gas car and installation of the electrical vehicle personally in a residential garage.

Tesla STEM High School, Redmond, Washington

Morgan Gilbert
Daniel Goto
Jacob Lee
Sohaib Moinuddin
Pauline Pfaffe

14 MAKING HOME RECYCLING EASIER USING TECHNOLOGY

Design

How can we set up an effective incentive-based recycling system to improve recycling behavior?

We implemented a program to reward students for recycling by giving them part of the 5¢ reimbursement many recyclable objects are eligible for. To do this, we designed a recycling bin that sorts non-recyclable from recyclable objects to reward students for recycling. Last year, we prototyped a bin that sorted an eraser from a soda can. This year, we designed an algorithm to sort all objects eligible for 5¢ reimbursements from objects that aren't. We then field-tested in a two-month study in eight different class periods to see if it improved recycling behavior, and used the reimbursement to sponsor a class social. We used paired t-testing to determine whether our bin significantly improved recycling behavior and performed cost-benefit analyses to determine market viability and potential.

Pullman Christian School, Pullman, Washington

Aneesh Pappu
Miles Saul
Aotian Zheng

15 CAN ATTITUDES AND BEHAVIORS BE MODIFIED THROUGH EDUCATION?

Behavior

How much can we change our food waste culture at our campus through convenience and facilitation of a new composting program and an awareness and education campaign?

We will survey a random sampling of students based before implementation of a composting program and education campaign, then administer the same test again after four weeks of concerted effort to educate and facilitate. At that point, we will compare prior use of composting food waste to current use and responses on the survey before and after the program was implemented.

Eatonville High School, Eatonville, Washington

Hanna Bridgham
Julianne Golding
Erin Long

16 WINDMILL-POWERED WATER HEATER

Technology

Can wind power be used to heat water?

Research and create a wind turbine that runs a heating element.

Liberty Bell High School, Winthrop, Washington

Stella Gunnip Hunter
Anna Post

18 THE EFFECT ON METHANE PRODUCTION DURING ANAEROBIC DIGESTION OF COW MANURE WITH ELECTROPHORESED ACID WHEY

Biofuels

Will electrophoresed acid whey increase methane production in an anaerobic digester as compared to regular acid whey?

We made acid whey, put in an electro-dialysis box, and ran an electrical current through it. Then, we made four lab-scale anaerobic digesters and put cow manure in each one. The control had just cow manure, while the experimental digesters held either regular, cathode, or anode action whey.

Henry M. Jackson High School, Mill Creek, Washington

Celia Evans
Madison Ransom
Hunter Saunders

19 SELF POWERED CHARGER

Technology

Can we transform kinetic energy into electricity to charge devices?

To put things simply, we are using a iPhone charger with our transformer. It works by shaking the device. As you do, coils wrapped around PVC generate electricity and send it to a capacitor which then goes into whatever adaptable device is selected.

TAF Academy, Kent, Washington

Zachery Carza
Tyrese Freeman
Devin Newberry
Jackson Patterson
Isaac Potter

20 INFINITE JUSTICE

Behavior

Is there a need to alert Emergency Medical Services that there is an alternative source of energy powering their property?

Students contacted multiple fire stations, EMS personnel, and police departments to see if there is a need for such identification on property. If so, we will contact the building department to see if it's possible to create a placard or sign that addresses this need.

Colville High School, Colville, Washington

Oliver Benson
Jared Lytle

21 USING PHASE CHANGE MATERIALS IN CONSTRUCTION

Technology

How can the technology of Phase Change Materials (PCM) become architectural innovations that reduce consumption of energy resources while revolutionizing architectural design in both residential and commercial applications?

Using phase change materials, we will design, build, and test architectural grade systems that will be innovative, visually appealing, and functional while greatly reducing the spaces' consumption of energy. PCM has a high potential to accomplish our goals due to its unique properties. Incorporating the physical reaction of PCM and the need for appealing green technologies for design and construction allows our team an opportunity to manipulate PCM to fit the different environmental specifications and temperature accommodations found in homes and workplaces. It will be challenging to determine if the innovative nature of the materials and their usage can be functional and practical from both an aesthetic and economic perspective.

Tri-Tech Skills Center, Kennewick, Washington

Jonathen Alcarez
Connor Belmont
Alexa Castellanos

22 CREATING AN ENERGY EFFICIENT CLASSROOM

Design

Is it possible to create a low cost, energy efficient classroom from alternative energy resources?

Calculate how much energy is being used in a classroom now. Find different alternative energy resources to use in a classroom. Then calculate how much energy the classroom being created is using.

Academy of Construction and Engineering—Marysville Getchell High School, Marysville, Washington

Miriam Arstad
Kenny Brown
Colin Downey
Alexis Harmon
Kira Johnson

23 USING A PHOTOBIOREACTOR WITH GENETICALLY ENGINEERED ALGAE AS A COMPREHENSIVE WASTE TREATMENT SYSTEM TO INCREASE THE ECONOMIC FEASIBILITY AND MARKET APPEAL OF BIOFUEL PRODUCTION

Biofuels

How can biofuel production from algae be made more economically feasible and less of an entrepreneurial risk during this stage of its market emergence?

Millions of dollars have been lost trying to use algae for large-scale biofuel production. We believe that in order to be economically feasible in the emerging market, algae must be marketed as something other than biofuel production. We propose marketing algae biomass as a valuable by-product of a low-risk, comprehensive waste-treatment system. Our photobioreactor design could be installed on existing industrial emissions or waste treatment systems. And we believe algae can be genetically engineered to meet the treatment requirements of nearly any effluent stream. To demonstrate this, we will design and construct a prototype photobioreactor that will use genetically engineered algae to simultaneously and effectively treat simulations of the three major industrial waste products: CO_2, heat, and chemical pollutants.

Kings Valley Charter School, Philomath, Oregon

Jacob Andrews
Jonah Bodnovits
Quinn Damitio
Ai Ana Richmond

24 BUILDING BETTER BURNING BUBBLES

Technology

What current technologies can be combined to build an effective off-shore fuel plant while keeping to the principles of marketability, sustainability, scalability, reliability, environmental stewardship, and natural healthiness?

We will do extensive research using detailed resources in order to redesign a sustainable process for fueling the transportation needs of tomorrow. Following our initial investigation, we will continue our project with hands-on, small-scale testing of sustainable technologies, focusing on combining offshore wind, wave, and solar energy. The aim of our tests will be to create a cost-effective and environmentally friendly system for the mass production and use of hydrogen, a potential solution for the environmental degradation caused by fossil fuels and natural gasses. The solution provided by our group will not only minimize damage to be done in the future, but it will also negate current environmental damage.

Ellensburg High School, Ellensburg, Washington

Langdon Ernest-Beck
Miranda Nover
Eric Wilson
Alexander Sumner

25 OPERATION DESERT FUEL

Biofuels

Is there a way to use cacti in the desert to create a clean, renewable source of fuel?

The operation involves harvesting cacti, crushing them to extract biomass and sugar water, and a chemical process to distill the sugar water into ethanol. The sugar water will be used for both ethanol and to stimulate new growth, while the biomass will be burned to generate electricity.

Interlake High School, Bellevue, Washington

Arden Chew
Karthik Meiyappan
Shuang Phillips
Gautham Velchuru

26 ANAEROBIC DIGESTER KIT FOR USE IN RURAL VILLAGE COMMUNITIES

Technology

What alternative source of fuel could provide the almost 3 billion people who rely on unsustainable and unhealthy biomass fuels like wood and charcoal with a clean, efficient cooking solution?

To explore a possible solution to the shortage of clean cooking fuels across the world, we will build and test a prototype anaerobic digester that can be built using recycled, cheap materials, big enough to provide a family with hours of cooking time daily. This digester, built using dual plastic barrels, would run on organic waste and manure, collecting methane produced by microorganisms to power a basic biogas stove, a sustainable and easy-to-maintain process. Our idea is to create a donation kit, including the stove and the small materials necessary to build the digester, that can be easily packaged and sent to communities in need. This process would allow donors to be involved directly in helping communities across the world, raising both awareness and compassion.

Tacoma School of the Arts, Tacoma, Washington

Brenna Gowin
Zachary Martin
Michael Morrissey
Ella Robinson

27 PUT A SOLAR PANEL ON IT

Design

What prevents people from getting solar panels, and how can we make them more accessible?

We will survey a number of people who live in Washington state to find out about their resistance to solar panels. We will also be calculating the cost-efficiency of solar panels, and whether solar panels are a sustainable means of energy. Finally, we'll investigate how efficient solar panels are in Pacific Northwestern weather.

Ballard High School, Seattle, Washington

Sophia Alvord
Cooper Bassett
Lauren Farrar
Lia Freeman
Caitlin Moore

28 IMAGINE TOMORROW TRANSPORTATION

Behavior

What factors create incentives and resistance to carpooling as a regular mode of transportation? Why does carpooling appear undesirable, and how can we make it better?

We identified restraints and disincentives regarding carpooling by exploring carpooling options and opinions at statewide, district, and local levels. We focused on developing a potential solution to increase participation in carpooling by making carpooling a convenient, gratifying, and worthwhile activity.

Ellensburg High School, Ellensburg, Washington

Abby Ernest-Beck
Uhuru Hashimoto
Elle Larson
Tamzen Shissler
Garrett Snedeker

29 GIVING GREEN: POWER VIA TREES

Technology

Can one harvest enough charge from a tree's natural flow of xylem and phloem to power a LED light and implement this technology to create new sustainable power sources?

The "Giving Green" project pertains to a series of tests performed on maple, pine, spruce, and oak trees. Using various metals and conducted materials, the "Giving Green" group was able to gather a charge from trees with the highest levels of active xylem and phloem. We've developed a product that harnesses the energy created from trees and that is able to power an LED light, a process which can be implemented to further move ourselves away from fossil fuels. "Giving Green" provides more than a new form of light, but a different form of power—a project we intend to keep alive.

Vancouver iTech Preparatory, Vancouver, Washington

Abigail Hughes
Jared Morales
Matthew Robinson
Kyle Rule
Cody Smith

30 THE TESLA NEEDLE

Design

How can a city more efficiently transmit energy?

Through the implementation of Tesla coils, cities can transmit and use energy in a safer and more cost-efficient way by using a method that does not use external wires and unstable methods of energy transportation.

Issaquah High School, Issaquah, Washington

Olga Andreeva
Serena Hansen
Christine Park

31 ACCELERATING THE REPLICATION OF *NANNOCHLOROPSIS* WITH THE ADDITION OF TETRAHYDRIDOCARBON FOR ENHANCING BIOFUEL PRODUCTION

Biofuels

Does methane (CH_4) increase the growth of the microalgae Nannochloropsis*?*

This project is an analytic study. There will be 2 cultures of algae (*Nannochloropsis*), one the control and the other is the variable. The cultures will be grown over the period of one week after which the amount of algae will be compared.

Academy of Construction and Engineering—Marysville Getchell High School, Marysville, Washington

Cameron Bartlett
Ross Turner

32 SUPER POWER SHOWER

Technology

How can we design a shower timer that encourages people to save water by turning off the water automatically at seven minutes?

We will use a solenoid valve, a programmable microcontroller, a relay module, and of course the shower head and hose running from the faucet. The programmable microcontroller and the relay module are programmed with the solenoid to stop the flow of water after the assigned time (seven minutes in our case).

Ballard High School, Seattle, Washington

Amirah Karam
Hanna McNamara
Lou Yardley

33 CELLULOSE: IT'S JUST TOUGH

Biofuels

Cellulose is abundant in the forest ecosystem, but difficult to use as a feedstock for bio fuels. Our project will explore cellulose properties, usage difficulties, and ecosystem effects.

Attention has been given to using cellulose as a feedstock for producing a biofuel product. When our team began looking at cellulose we soon found that there are many biofuel challenges and difficulties due to how cellulose is put together. Our project looks at the structure of cellulose, why it is tough to work with, and possible uses of cellulose feed stocks that are not processed all the way to a fuel product. We also will research how cellulose is broken down with the help of naturally occurring enzymes produced by fungus and the ongoing work to find a biological process that is efficient and cost effective method to produce a cellulosic ethanol.

Lake Roosevelt High School, Coulee Dam, Washington

Olivia Arnold
Terrance Jim
Marissa LaFountaine

34 RURAL ELECTRIFICATION AND SOLAR PANEL SYSTEM MODEL

Design

How can we design a sustainable, off-grid rural electrification system to empower developing countries?

We will research current rural electrification systems and enhance them with our knowledge of energy as well as design. We will then develop a rural electrification system that is more efficient than that of the current state. We will provide a long-term plan, with smaller milestones, for a smooth and systematic implementation of our model in various rural areas.

Interlake High School, Bellevue, Washington

Mahalaxmi Elango
Justin Lee
Nivedita Potapragada
Meera Srinivasan
Muyi Zhang

35 PALM OIL AND HIGH SCHOOL STUDENTS

Behavior

How can students at Henry Foss High School be persuaded to change their consumption habits to eliminate products containing unsustainably grown palm oil?

This question was addressed with a combination of data-gathering through surveying Foss students of various ages, races, and socioeconomic statuses; presentations about the various harmful outcomes of unsustainable palm oil production; and awareness campaigns tailored to the results of the various surveys.

Henry Foss High School, Tacoma, Washington

Grace Lee
Rosabeth Schultz
Binh Truong
Beatrice Wilson

36 SMALL SCALE HYDROPOWER

Technology

Can a collapsing water wheel be used to produce small scale power from various sources?

This project involved development and refinement of a collapsing water wheel that can be placed in either in a pipe or in a small stream.

Colville High School, Colville, Washington

Justin Branson
Travis Hegney
Andrew Violette
Arman Naderi

37 IMAGINE SEATTLE TOMORROW

Design

How to design an integrated transportation system to mitigate greenhouse gas vehicle emissions and encourage an environmentally sustainable future in The Greater Seattle Metropolitan area?

We obtained data and information about the current transportation infrastructure in Seattle to anticipate future needs and solutions. Our models and maps were created using GIS systems and our indepth analysis of demographics. We designed a system to accommodate the needs of commuters with a variety of solutions, from cyclists to drivers. We also meet with city officials in order to fully understand the current pitfalls of our current transportation system.

Tesla STEM High School, Redmond, Washington

Surya Cidambi
Coby Colson
Atul Madhugiri
Kevin Nakahara
Naveen Sahi

38 ENGINEERING AN AFFORDABLE AND LOW-ENERGY PERSONALIZED SECURITY SYSTEM UTILIZING QUICK RESPONSE CODE TECHNOLOGY

Technology

How can a personalized security system be engineered to be effective and efficient in cost, use, and energy?

QR code technology is used to match codes with one stored in a database on the device. When a code matches one that's stored, a text message is sent out to the admin's phone number, alerting that the person associated with the code has arrived home. After the match is successful, the device also moves a deadbolt and unlocks a door.

Henry M. Jackson High School, Mill Creek, Washington

Lessane Ketema
Jeremy Steckler
Devin Sykes

39 TECH CHILL

Behavior

How does the implantation of a thermal-stimulating device change a person's propensity to turn on the air conditioner?

We plan to test three different scenarios, first is a simple sock with refrigerant gel, then next is a weighted exercise band and replacing the weight with gel packs. Finally, we plan to test an exercise and replacing the weight with hand warmers.

Quincy High School, Quincy, Washington

Carla Beltran
Maycohol Chavez
Arturo Escalante
Eric Navarro
Luis Guerrero

40 S.A.S.S.

Technology

How can we repurpose existing clean technology to fit the needs of specific people while maintaining sustainability, and how can this technology be used to better mankind and the world?

The SASS (Solar-Assisted Sonar Sensor) is a 3D sonar helmet for use by both the civilian populace along with government agency employees such as firefighters. The SASS uses 3D sonar technology to deliver a 30 fps live feed of the area surrounding the user with a topographic texture into an Oculus-Rift-styled lens. This allows the user to see in any situation, whether the room is dark or full of smoke or particulates. This is an example of sustainable advanced electronics for the betterment of our lives. The entire device is contained in an eye-and-helmet ensemble, powered by a solar-charged laptop backpack that weighs no more than two pounds. This allows for longer operations with no need to go back and recharge.

Vancouver iTech Preparatory, Vancouver, Washington

Matthew Bade
Damion Mcloone
Zachary Sandoval
Cobalt Sjögren

41 POWERING A GRID THROUGH FOOTSTEPS

Design

Can kinetic energy be used to power city infrastructure?

This project involves testing high-traffic walking areas as a means to generate sufficient energy to power traffic lights.

Sentinel High School, Missoula, Montana

Joseph Cox
Ben Lotto
Garrett Morris

42 GO, GO TEAM ROCKET

Technology

How can we make a rocket that is more energy efficient than conventional chemical rockets today?

We plan to build a small-scale prototype of our energy-efficient rocket with more current technologies and design methods. We will test technologies that are now plausible, such as engines and material design. Then, as a control for our testing, we will test other small-scale conventional rockets along with our prototype to prove that our new rocket is more energy efficient.

Vision Charter School, Caldwell, Idaho

Brock Anderson
Lilian Bodley
Brandon Rowe
Riley Woodworth

43 CHECK US OUT! FUEL CELLS AND SOLAR-POWERED CONVERSATIONS

Technology

How can solar-powered fuel cells be a viable alternative to the standard cell phone battery?

We will build a variety of prototypes of fuel cells to test as many variables as possible: voltage, amperes, pressure, surface area of metal, types of metal, and shape of container. We will additionally use electronic sensors to electronically graph as many variables as possible as we change them to correlate. Our goal is to find the smallest, lightest, and most efficient fuel cell combination. This will then be part of a solar charging station, tested on a college campus.

Vision Charter School, Caldwell, Idaho

Samuel Hammond
Gavin Rapp
Nolan Rehm
Esteban Ruiz
Nathaniel Tollman

44 RECYCLING WASTE HEAT FOR BIOHYDROGEN GENERATION

Biofuels

We have created a novel system for generating biohydrogen by recycling waste heat from distributed power generation to warm the processes of biohydrogen generation.

In our system, a co-culture of *C.Thermocellum* and *C.Thermosaccarilyticum* digest cellulose to produce hydrogen and ethanol. The ethanol is converted to hydrogen via ethanol steam reformation. Hydrogen from both sources is fed to large fuel cells for distributed power generation. Waste heat from the fuel cells is recycled to maintain the bacteria and heat the ethanol steam reformation process.

Tesla STEM High School, Redmond, Washington

Zechariah Cheung
Maheck Jerez
Margo Nanneman
Claire Yin
Ben Zabback

45 USE OF BIOLUMINESCENT BACTERIA TO MAKE A LIGHT BULB ALTERNATIVE

Technology

Could the bioluminescent properties of Vibro fischeri be harnessed and used as an alternative source of light in everyday life?

We will be mixing different different agar solutions, and testing how additives to a photobacterium agar formula will affect *Vibro fischeri* growth and glow. The additives that will be tested are red yeast, calcium carbonate, and starch. Additives will be mixed with photobacterium agar solutions at varying interval amounts (0 ml, 5 ml, 10 ml). *Vibro fischeri* cultures will be exposed to Petri dishes with different agars. At 12-hour intervals, each plate's glow will be measured with a photometer.

Camas High School, Camas, Washington

Cade Greseth
Tobias Pizot
Brenton Riddle
Genya Shimada

46 3D PRINTED PROSTHETIC HEART

Design

How can replacement hearts be made more available?

The 3D printed prosthetic heart is a culmination of an interdisciplinary effort to achieve the common goal of a heart that will replace someone's failing heart. The point of 3D printing is to add the ability to quickly customize the heart to the patient's personal anatomical specifications. In addition, 3D printing material is cheaper than most metals used in prosthetics. In order for this heart to function properly, effort was put into four categories: blood flow, blood vessel connection, power supply, and anti-microbial properties for 3D printed material.

Issaquah High School, Issaquah, Washington

Alexandra Kuo
Connor Moo

47 SAVE IT ON A RAINY DAY

Technology

How can we utilize rainwater and sustainable hydroelectric technologies to create a device that will allow us to generate electricity while also creating usable drinking water?

We will create a device that is a combination of a microturbine and a water filter. The device will take in rainwater from a gutter, run it through the turbine to create electricity, then run the water through filters into a storage tank. We will attach our device to the gutter of the local senior center, and it will run and charge batteries while filtering water. We will use the charged batteries to power devices in the center and the filtered water as drinking water for the seniors.

Bonney Lake High School, Bonney Lake, Washington

Elizabeth Rice-Reynolds
Arianna Schultz

48 GMOs

Behavior

Can educating people about the science behind genetically modified food organisms (GMOs) alleviate their fears of consuming these products?

We will first research the different techniques by which GMOs are created. By explaining those techniques to consumers and by explaining the many benefits of developing GMO food crops, such as having to apply less pesticides, less herbicides, and thereby using less fuel to apply these chemicals, we want to change consumers' perceptions of GMOs. After our presentations to community members, we will conduct surveys to see if their opinions have changed and whether they feel research should continue in developing energy-efficient genetically modified food crops.

Yelm Extension School, Yelm, Washington

Trista Handlen
Myrna Henry
Austin Kepple

49 INCREASING THE EFFICIENCY OF PHOTOVOLTAICS BY CONCENTRATING VISIBLE LIGHT THROUGH REFLECTION

Design

In areas with limited amounts of sunlight, how can photovoltaics be made more efficient, thus providing incentives for citizens to utilize solar technologies?

We will be utilizing Arduino IDE and servo motors to move mirrors that will be attached to the edges of mirrors. This system will then be attached to a GPS device, which will allow residential users to input their latitude and move the mirrors without human assistance.

Tesla STEM High School, Redmond, Washington

Nicholas Bo
Claudia Nguyen
Aditya Ramanathan
Allison Tran
Vibha Vadlamani

50 VACTRAINS

Technology

What is a more environmentally sound and energy efficient alternative to long-distance air travel, and how effective could it be?

We will build a working model of a vactrain and test the speed in normal atmospheric pressure and in a vacuum. We will also show how vactrains can be beneficial in terms of energy consumption and a minimal impact on the environment, especially as compared to airplanes.

Ballard High School, Seattle, Washington

Theron Baker
Rowan Coon
Michael Detels
Derek Kirchmeier
Charlie Nickerson

51 GENERATING ELECTRICITY FROM INDUSTRIAL WASTE HEAT

Biofuels

How can we use existing materials to create a more cost-efficient thermoelectric module that is capable of recovering industrial waste heat and generating electricity effectively?

Our project seeks to make use of environmentally-benign and cost-efficient thermoelectric materials in order to harness industrial waste heat and generate electricity (Seebeck Effect). Sustainability and commercial viability were prioritized in this novel design by using Tetrahedrite and Magnesium Silicide. Fabrication of this device involved polishing the thermoelectric dies, metallizing their surfaces, and insulating the system with ceramics. Testing was done by exposing it to a range of temperatures with a hot plate and measuring its voltage, resistance, and current with a multimeter to determine its power output. The efficiency of the module was calculated based on material properties and operating temperature, and cost comparisons were drawn using bulk thermoelectric material costs. Boosts in fuel and electrical generation efficiency can be achieved with this technology.

Henry M. Jackson High School, Mill Creek, Washington

Heejoon Ahn
Sriharshita Musunuri
Indira Rayala

52 GREEN INTEGRATION

Design

How can alternative energy sources and conservation methods be combined to make an economically plausible, but yet environmentally friendly home, in the Caldwell, Idaho, area?

We will research types of products required to build a home in our area, how they are implemented in the home, and how we can use alternative products, for roughly the same price, to build a home. We will also be researching alternative ways to power a home, such as solar or wind energy, that are also economically possible. In addition we will design our "green" house and build some of the components such as the grey water recycling system.

Vision Charter School, Caldwell, Idaho

Ryska Baird
Abigail Blair
Andrew LaMasters
Samantha Snow

53 THE FUTURE OF THE FILTER: ASSESSING THE EFFICACY OF HYDROCHLORIC-ACID-ACTIVATED GRAPHENE SAND FOR REMOVING MULTIPLE CONTAMINANTS FROM WATER

Technology

What is the efficacy of hydrochloric-acid-activated graphene sand composite for filtering heavy metals, E. coli, dye, salt, and pesticides?

We will create graphene sand using a modified mix of graphene pioneers Gupta's and Smith's methods. To test our filter, we'll assess its efficacy for purifying water contaminated with heavy metals, *E. coli*, dye, salt, and pesticides. We'll then conduct t-tests to determine if there's a statistically significant difference between contaminated water and water filtered through graphene sand composite.

Camas High School, Camas, Washington

Daniel Fan
Gabriel Mukobi
William Sun
Noah Thompson

54 DEVELOPING A BIOFUEL DERIVED FROM INVASIVE *RUBUS FRUTICOSUS* BYPRODUCT

Biofuels

Can an efficient and sustainable bio fuel be mass produced using invasive Rubus fruticosus*?*

Identify Himalayan blackberry plants by seeing if they have white flowers and red stems. Harvest three five-gallon buckets of Himalayan blackberry branches. Shred branches using blender until quarter-sized chunks are produced. Separate the chunks into two groups labeled A and B. Leave the chunks of group A to dry, then place the chunks of group B in water to soak. Place group A into press at 580 PSI. Remove briquette from bottle jack. Dip briquette cylinder into melted canning wax. Repeat steps 5-7 for group B. Light briquette and block of cedar wood at same time. Record data and see which product burns longer and achieves a higher temperature calorimetry. Compare the two data tables to see which fuel is more efficient and sustainable.

Academy of Construction and Engineering—Marysville Getchell High School, Marysville, Washington

Sean Aragon
Andrew Burns
Troy Hall
Shawn Madamba
Nolan Wall

55 HARNESSING THE POWER OF RAIN

Technology

How can we harness the hydro power of rain so that we may harness a renewable energy source while also factoring in weather and the intricacies of an unpredictable source?

We will attempt to create schematics and a plan of implementation, in addition to a crude prototype, to harness the power of Western Washington's rainfall by means of a rain gutter turbine. While completing this task we hope to work out size, placement, any modifications of existing gutter structure, the mechanics of surviving freezing and thawing, how to weather dry spells, and how many turbines are needed to efficiently produce energy.

Eatonville High School, Eatonville, Washington

David Bacher
Hana Boyce
Savannah Haglund
Simion Hleborod
Janelle Thirtyacre

56 DEVELOPMENT OF A UNIVERSAL HAIR DRYER ATTACHMENT FOR INCREASED ENERGY EFFICIENCY

Design

Will adding an external attachment filter to a hair dryer without a changeable filter save energy in the long run?

First, gather materials needed to measure the hair dryer. Then measure the hair dryer using measuring tape and a dial caliper. Measure the filter for the external piece. Design an external piece for dryer on a CAD program and then develop and print with a 3D printer. Affix filter to printed external piece. Using a watt-hour meter, plug in the unchanged hair dryer, turn on for 10 minutes, and record watts being used for two trials. Add the attachment piece to the hair dryer. Now, test the redesigned hair dryer for same amount of time for two trials. Lastly, compare data and chart results.

Academy of Construction and Engineering—Marysville Getchell High School, Marysville, Washington

Noah O'Neall
Brandon Rodarmel
Alexis Samuelson

57 SOLAR-POWERED ROADWAYS

Technology

How will solar roadways help reduce solar emissions?

We are going to create a model, draw diagrams, and write a research paper(s).

Liberty Bell High School, Winthrop, Washington

Josh Dinham
Finlay Holston
Cecelia Odell
Haley Post

58 MOBILIZED AIR

Technology

Will it be possible to design a portable, solar air filtration device that can be marketed to citizens in high-population, high-air-pollution areas?

Our group will design a compact, energy-efficient, cheap, and effective air purifier. Our primary aim is to build a device that families in any country that has bad air pollution can purchase.

Henry Foss High School, Tacoma, Washington

Thomas Hoang
Ethan McLean
German Navarro

59 GLOBAL ENERGY PLAN

Design

How do we achieve sustainable total global development?

The goal of this project is to create an energy plan for the United Nations in the form of a UN treaty. Based on a region-specific business model, we aim to create the best solution for achieving the area's energy needs by selecting a type of energy source and mapping out the profitability after implementation. We will make calculations on feasibility of powering the world and create a budget which the United Nations can spend to construct our model, or to use our findings to aid their own plans. We plan on delivering our message to the United Nations as a treaty aimed at the UN council gathered for the Climate Summit in hopes of convincing their assembly to sign onto our proposal.

Tesla STEM High School, Redmond, Washington

Suraj Buddhavarapu
Teri Guo
Dinesh Parimi
Udit Ranasaria
Ben Trowbridge

60 PROJECT UNSUCK

Technology

How can we eliminate vampire energy from homes across the globe?

We have created a sustainable, cost-effective way for home owners to eliminate vampire energy at its source. Our Wi-Fi-enabled outlets plug into sockets before a device is plugged in, so when used with our app you can select specific outlets to be turned off completely, blocking vampire energy for the amount of time you have selected.

Ballard High School, Seattle, Washington

Lauren Croxton
Hannah Rubens
Anna Shoner
Lauryn TIlev

61 SUSTAINABLE FARMING FOR THE FUTURE

Design

How to modify a current farming establishment to be more economically stable and energy efficient in order to be a benefit to the health of people and of the environment.

We will conduct a lab experiment to explore the efficiency of cellulosic biomass in the creation of ethanol. The biomass used will reflect the substances most wasted on farms in Western Washington.

Another part of our research will include the degradation of soil and how to best counteract such effects through specific crop rotation. Nutrients will be replenished by other crops rather than expensive or harmful treatments. For the final part of our project, we will research the most recommended method of irrigation and provide evidence for why we choose to operate with such a system.

Bonney Lake High School, Bonney Lake, Washington

Eric Johnson
Kimberly Woolery

62 CREATING CELLULOSIC ETHANOL FROM FOOD WASTE

Biofuels

Is cellulosic ethanol that is produced from food waste strong enough to run an engine?

Have hole in the cap of the bottle with diameter (1 cm). Attach the first end of a hose to the cap, and the other end of it through the top hole of the bottle. Make sure that the hose that is in the inside of the bottle is in a spiral shape. Place fruit peel (400 g) in the two-liter jar. Add 1 cup of sugar and 2 tablespoon of yeast, add 1 cup of water. Seal the jar with a rubber glove. Store jar in a warm, dark place and leave it to ferment. Put liquid from surface of mixture into another jar. Seal the jar with the cap that has the attached hose. Pour 1 liter of water into the pot and heat it up. Put the jar with the seal into the pot.

TAF Academy, Kent, Washington

Vladislava Chiosac
Katerine Guzman
Derek Jacobus
Caleb McCarthy
Brigid Overman

63 THE FAULT IN OUR WINDMILLS

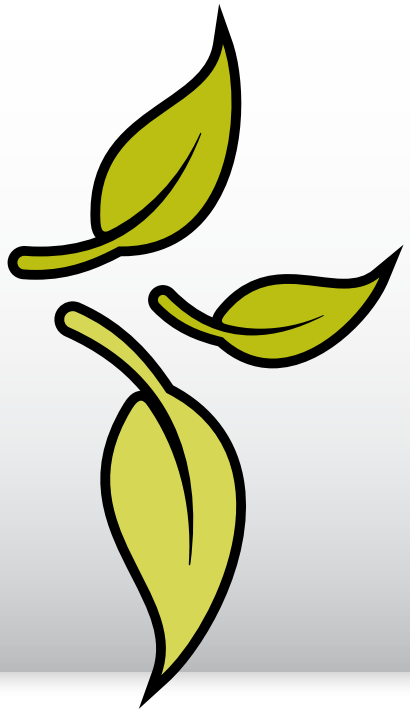
Technology

How can a kite be designed to create electricity by turning a generator without having to exert energy by reeling in the kite once it completely unwinds its string?

Our group will use Bernoulli's principle to guide our design as we modify a kite so that it will increase its angle of attack and stall or fall when it is at its maximum altitude. After stalling for a short period of time, the kite will reduce its angle of attack and rise again and repeat a cycle that will allow us to continuously turn a generator as long as the wind blows. A system of rubber bands on the kite replacing normal strings will allow the kite to increase its angle of attack and subsequently return to normal as it stalls.

Camas High School, Camas, Washington

Samantha Guthrie
Jason Kim
Wyatt Lewis
Jeffrey Liao



64 TAKE A STEP TOWARDS A BRIGHTER TOMORROW

Design

How can piezoelectric tiles be built into staircases to generate a clean source of electricity and lower energy bills?

We will research the amount of electricity piezoelectric tiles generate, and build a model of a stair that has piezoelectric tiles built into it. Additionally, we will figure out how much Ballard High School would save on its electricity bill if our piezoelectric stairs design was implemented in the building. Previous Imagine Tomorrow participants have investigated and tested various piezoelectric designs. Our project aims to go one step farther and create a piezoelectric circuit connected to a capacitor that is able to store the generated electricity for later use.

Ballard High School, Seattle, Washington

Sammy Blue
Liat Carlyle
Jade Henderson
Julia Jackson
Audrey McFarland

65 ENGINEERING A WATER PURIFICATION SYSTEM THROUGH MANIPULATION OF THE REFRACTIVE PROPERTIES ASSOCIATED WITH RECYCLED FRESNEL LENSES

Technology

How can we engineer a water purification system using recycled Fresnel lenses?

By using 10 small wallet-sized Fresnel lenses. Creating a Buckyball-type dome. Having polluted water reach a boiling point using a focal point of refractive light created by Fresnel lenses. Use steam by trapping in a tube to cool down. Once cooled enough, the steam turns into distilled water and we collect the distilled water in a container.

Academy of Construction and Engineering-Marysville Getchell High School, Marysville, Washington

Tiana Lacoste
Christian Lopp
Zachary Moore
Sevtap Sahin

66 GRAPE POMACE BIODIESEL

Biofuels

Can grape pomace, also known as winery waste, be converted into biodiesel?

To make biodiesel, we had to perform hydrolysis to the grape pomace to extract fermentable sugars. Then these sugars were used as a fermentation medium for the oleaginous yeast *Yarrowia lipolytica*, This yeast is known to bioaccumulate lipids from sugars. These lipids are the base reactants for biodiesel. After testing, significant growth was observed and we know the lipids can be converted to biodiesel.

Henry M. Jackson High School, Mill Creek, Washington

Jean Kim
Dhruvik Parikh
Dane Smith

67 ANALYSIS OF HOW THE LEGISLATION OF I-502 AFFECTS THE CARBON FOOTPRINT OF WASHINGTON STATE

Design

Should Washington's legislation on I-502 include lighting and seasonal requirements to reduce the overall carbon footprint?

Analyze Washington's legislation. Interview people from PUD on the effects of cannabis on the electricity usage of Washington. Gather information on where we get our electricity (e.g., renewable sources, coal, fossil fuels). Compare carbon footprint without legal cannabis production and carbon footprint with legal cannabis production. Grow beans using HID (HPS and MH) lamps and LED lamps, analyze how well the beans under each lamp grow. Make suggestions for revising I-502.

Academy of Construction and Engineering—Marysville Getchell High School, Marysville, Washington

Christopher Lowe
Joe Ralph
Nicolaos Vorachak

68 POWERING CARS THOUGH SOLAR ENERGY

Technology

Can we power a remote-controlled car with a solar panel?

We will construct a solar car from the remote-controlled car and use it as a model for a real solar car.

Liberty Bell High School, Winthrop, Washington

Grayson Alexander
Noah Batson

69 SOLAR POWERED PHONE CHARGER

Design

Is a Solar Powered USB Charger as efficient as an Outlet Charger?

For our project we first got our materials from Amazon. Then we followed our procedure.

Take the empty Altoids can and drill a square shape to fit the USB in the side of the can. Drill two holes in the top of the can's lid. Tape the solar panel with electric tape on the top of the can's lid. Tape the 5V regulator, the 9V battery and the female regulator inside the Altoids can. Connect the positive (red) and negative (black) wires to the back of the solar panel regulator and battery. Plug the USB phone charger into the USB female end. Then we tested our prototype and recorded our observations and data.

TAF Academy, Kent, Washington

Annette Acheampong
Alexis Keo
Yoshadrach Malabad
Yohairah Erika Malabad
Aaron Spires

71 MODULAR ALGAE FARMING

Biofuels

Can consumers benefit from the use of an algae biofuel farming network that would utilize unused roof space in the United States?

The "Modular Algae Farming" project is intended to grow a high yield biofuel algae crop while taking advantage of unutilized space on the roofs of homes and businesses. The construction is designed for scalability that allows the system to fit on roofs of all shapes and sizes. The system works by circulating algae around a network of tubes and allows the algae to be drained when ready to harvest. After the algae is drained from the tubes, it is filtered out from the water and squeezed to release the lipids that can easily be converted to biofuel with a few chemicals and processes.

Ballard High School, Seattle, Washington

Luke Seeley
Kale Zweig

72 NET-ZERO ENERGY CITY

Design

Is it truly possible to create a city that produces the same amount of energy it uses?

By using green building techniques, natural resources, conservation, green technology, and optimization of organic resources, we can easily create a city that is designed to use the same amount of energy that it produces. Moreover, we will design this city in a manner that allows it to harbor jobs made for individuals participating in jobs that include, but are not limited, to: mechanical engineering, material sciences, civil engineering, chemical engineering, economics, and various other professions that a net-zero energy city would need to constantly thrive.

International Community School, Kirkland, Washington

Matthew Calligaro
Gregory Cheng
Karthik Krishnan

73 KNOW WHAT'S RIGHT, DO WHAT'S RIGHT

Behavior

Can we increase the amount recycled with positive imagery and marketing in our environment?

First, we will collect our school's recycling for one month, with no signage or propaganda. Second, we will create posters and use other marketing tools around our school to advertise and encourage the use of recycling bins over trash. Then we are going to record the amount of waste recycled in the one-month period during the use of marketing tools. "

Klahowya Secondary School, Silverdale, Washington

Rebecca Flint
Kate Little
Alanna Spicer
Julia Zimny

74 JATROPHA CURCAS: A PROMISING NEW SOURCE OF BIOFUEL

Biofuels

Is it possible to produce bio-fuel from Jatropha curcas seed cake through anaerobic digestion?

Cow dung is collected from the nearby farm and is left to ferment. Water is added to the cow dung so that it can become dilute. Jatropha seed case is cleaned with water. Both Jatropha and cow dung are mixed in certain ratios. After some time, biogas is collected.

Interlake High School, Bellevue, Washington

Rahul Chaliparambil
Veenadhari Kollipara

75 LIFESAVER TECHNOLOGY

Is there a way to charge your cell phone while you are using it and without having it plugged into anything?

We would like to design a product which uses piezoelectric material to capture the pressure that is used while using your phone.

Pullman Christian School, Pullman, Washington

Cameron Hewitt
Sarah Lindstrom
Zoe Niska
Hanna Wofford

76 ONE MAN'S TRASH IS ANOTHER MAN'S TREASURE

Biofuels

Is it possible that if our team burns enough food waste to produce syngas, then can we convert it to energy to power our school?

To conduct our study, we researched the McCleary Decision on Public Education, school energy, actual usages, alternatives, chemical process, biofuel generator model, incineration vs. gasification, anaerobic bacteria, and school energy bills. Our research provided our conclusion.

Klahowya Secondary School, Silverdale, Washington

Lacey Crawford
Tori Stevens
Brielle Stevens

77 RENEWABLE WIND ENERGY AT SKYVIEW HIGH SCHOOL

Technology

Is it efficient to help power and reduce the carbon footprint of a large school with wind energy?

The project involves researching how wind renewable energy works, how it is beneficial at Skyview High School, and how can it be applied to other schools. The project included determining a spot where the maximum amount of energy could be produced. Finally, we got in touch with community members who are experienced with renewable energy sources and learn the science behind it.

Skyview High School, Vancouver, Washington

John Bower
Patrick Gaines
Brandon San

78 GAIA CITY

Design

Can we design a city that is energy efficient, benefits wildlife, and is a place that attracts people as an interesting place to live?

We are working on developing a new standard for energy-efficient cities and using the city design to create a culture of citizens who make conscientious actions in terms of environmental and human health. Using research from new and up-and-coming innovations, current effective designs, and polling of our community we are developing a design for a city that benefits the quality of life for humans and the natural world for generations to come.

Olympia Regional Learning Academy, Olympia, Washington

Grace Blaylock
Cedar Cividanes
Jared Cline
Gabrielle Gariepy
Skylar Linden

79 THE HYDROGEN EDGE: FUELING INFRASTRUCTURE OF THE FUTURE

Technology

FCVs are being released next year, but there isn't sufficient infrastructure to support them. How does one create a station that's inexpensive and environmentally friendly?

Design a modular, scalable, efficient, low-yield electrolysis station established as an interim solution between the current gap of fueling stations and the future inundation of large-scale commercial fueling stations that will prove both economically and geographically viable.

Lake Stevens Senior High School, Lake Stevens, Washington

Jared Graef
Evan Rose

80 METHANE BIODIGESTER

Biofuels

Can we create a cheap, renewable, simple, and green device that can give fuel to people with little money or access to materials?

You will need 2 10-gallon tubs, 1 rectangular big tub, 2 white flexible tubes, 1 PVC pipe, any kind of animal feces (preferably cow or horse), and water-proof sealant.

TAF Academy, Kent, Washington

Evangeline Coco
Sarah Jacob
Asillia Jacobs Kalyan
Allison McIntyre
Devin Metz

81 MORE SUSTAINABLE NEIGHBORHOODS

Design

How can neighborhoods change to become more energy efficient?

Research and create a model of a better suburb.

Liberty Bell High School, Winthrop, Washington

Eden Leigh Davis

Carson Gunnip-Hunter

82 THE POWER OF COMPOST

Technology

How can we use the heat generated from compost to bring a small amount of electricity to rural off-the-grid areas?

We will build a sustainable, energy-producing device to harness the heat energy produced by aerobic digestion of a compost pile and convert it into electrical energy using the technology of thermoelectric generators. Though it will produce a small amount, this electricity is clean, free, and constant because the source of the energy comes from compost, which everyone produces. Our device will power small appliances that require low amounts of electricity; this power can be applied to off-the-grid areas of the world.

Ballard High School, Seattle, Washington

Sophie Adams

Claire Aiello

Addison Baker

83 SEATTLE! WATER YOU WAITING FOR?

Design

How can we use the immense amounts of rain in Seattle to our energy advantage?

We will design water turbines using sewer and storm water.

International Community School, Kirkland, Washington

Felix Guo

Rachel Leu

Koyo Nakamura

Maximus Pang

85 LET'S GET PHYSICAL

Technology

Can we harness the kinetic energy created daily by workout centers and gyms and use it as a sustainable energy source?

We will conduct research into kinetic energy and energy transfer processes, then calculate the economic impact and benefits of our concept and its forecasted environmental footprint on our city. We will also research which machines would work best with our apparatus.

International Community School, Kirkland, Washington

Julia Abouelheiga

Stephanie Fulton

Stella Gonzalez

86 CHROMAHOME

Design

Does painting a structure with thermochromatic paint affect the ambient temperature and thereby lower heating and cooling costs?

We will build two miniature models of a house, paint one with the thermochromatic paint, and leave the other unpainted. Both models will be placed outdoors and the internal temperature monitored. We will compare the data for each model and calculate the possible energy savings for the structure with the thermochromatic paint.

Vision Charter School, Caldwell, Idaho

Cade Anderson

Jackson Dial

Kenadi Swendsen

Eli Wood

87 THE COMPACT HYDRO WHEEL

Technology

Can micro-hydro change energy use in a household?

Research and construct a micro-hydro power generator.

Liberty Bell High School, Winthrop, Washington

Luc Lachapelle

Camren Nielsen

Cade Quigley

Mackenzie Woodworth

88 ALQI: FUELING THE FUELS OF THE FUTURE—ALGAL BIOFUELS

Biofuels

How can we maximize algae production on the least amount of land?

After researching existing algae production facilities, we produced a concept photobioreactor incorporating elements aimed to increase biomass output per square meter per day. Each element will be tested in isolation to determine its effect on productivity. The data will be used to improve upon the design. Once the design is finalized, it will be scaled up to simulate real-world functionality.

Lake Stevens Senior High School, Lake Stevens, Washington

Gary Lam

Marleigh Olson

Nathan Richmond

Marc Tiotangco

Hannah Weymuller

89 CHURNING THERMAL POLLUTION

Design

Can riffles be used to successfully cool and reintroduce dissolved oxygen to thermal power plant effluent?

We will design a system of riffles to cool water and reintroduce dissolved oxygen to thermal power plant effluent in a more cost-effective manner than current cooling techniques. These riffles are meant as either an addition to current techniques or a substitute in developing nations.

Camas High School, Camas, Washington

Calvin Taylor
Phoebus Tsai
Daniel Yan

90 CROWDSOURCING CARBON OFFSETS

Behavior

How can we incentivize individuals to take a more active role in carbon footprint reduction?

By dissecting the motivations of individuals to engage in environmentally responsible behavior, we will find the best method of encouraging personal environmental accountability and how best to instill that motivation on a wide scale.

Sentinel High School, Missoula, Montana

Taiga Gamell
Erin Johnson
Ryan Mason
Jackson Petty
Max Thibeau

91 MAGNETIC MOTOR

Technology

How can we improve the modern renewable electricity generator while creating a product that differs from today's generators?

For this project, we plan to build a small-scale model for testing. In order to accomplish this, we must run the model throughout different scenarios while collecting data. Later, we plan to rewrite the data in a way that fits a real-sized scale model. While writing this, we plan to address how this idea can be applied to other environments and what we have to improve so that it can handle more than one climate.

Vancouver iTech Preparatory, Vancouver, Washington

Darlene Gray
Carlos Mercado
Adelaine Nielson
Shayla Asher

92 WHY NAUGHT?

Behavior

Why don't people in our region find it worthwhile to recycle?

The project involves surveying a group of people in a neighboring town and comparing the results to those of the year previous from our own town.

Quincy High School, Quincy, Washington

Abelardo Diaz
Claudia Flores
Ruth Garcia
Alejandra Garcia Tovar
Celeste Orozco

93 SELF-SUSTAINABLE HYDROPONIC GARDEN

Design

Can utilizing a self-sustaining hydroponic gardening system bring fresh organic vegetables to urban environments and third-world countries? Can we lower our carbon footprint by minimizing transportation of produce?

We intend to design and build a functional hydroponic garden that focuses on current issues in our urban environments as well as in third-world countries. We intend to address these issues by creating a self-sustaining hydroponic garden that utilizes solar rays to charge a battery that will power a submersible pump. This design will be cost efficient, reduce carbon emissions, and utilize the natural resources around us such as sunlight and rain water. We will be able demonstrate this theory by growing vegetable plants in our hydroponic garden as well as showing the effects of growing the produce closer to the people.

Tri-Tech Skills Center, Kennewick, Washington

David Armenta
Jovany Farias
Enrique Leal
Alan Vasquez

94 MAKING BIOFUELS FROM ALGAE

Biofuels

How can biofuels be efficiently produced from algae?
How does this fuel compare to diesel and other biofuels?

First, study algae growth with various fertilizers. As algae becomes more mature, move culture to larger tanks. Harvest the algae through one of the two methods: filtration and flocculation. Finally, perform Burn tests with a variety of fuels and biofuels to compare algae oil energy density.

Skyview High School, Vancouver, Washington
Nolan Kiem
Skyler Lemmon
Akhil Mulpuru
Samir Sen

95 GEOTHERMAL ENERGY AS REPLACEMENT

Technology

What is geothermal energy and how is it beneficial to us?

A 15.25 oz. tin can with lid removed, hammer, 1/8" diameter nail, a thin piece of wood, 3 rubber bands, a medium-sized pot, aluminum foil, pinwheel, timer, oven mitt, stovetop, and 2 quarts of water (1892.70589 ml) were used. A pot of boiling water is covered with foil. The device is placed on top and the pinwheel hovers over it. The pinwheel rotating is what is being measured.

TAF Academy, Kent, Washington
Taytum Bond
Abraham Cornejo
Shaylyn Karan
Ameera Mustafa
Confidence Orji

96 YOU GET THE BIOFUEL FROM THE COCONUT

Biofuels

How do we keep coconut oil in a liquid state at lower, nontropical temperatures?

We will take solid coconut oil and attempt to refine it to remove those compounds that make it solid in a transesterification process. This will allow us to keep the oil in a liquid state at lower temperatures. We will then burn the biofuel in a two-stroke motor to see how efficient the product is.

Vision Charter School, Caldwell, Idaho
Warunchalee Chuemuengphan
Tianna Flatt
Alexandria Kearsley
Darbi Tackett

97 BLUE

Design

What could be done to make a city more efficient and eco-friendly, while maintaining a reasonable price for average citizens?

Our answer was to start with apartments. You can slant the roof in four directions keeping the top flat, forming a flat-topped pyramid.

Pullman Christian School, Pullman, Washington
Jong Ho Bak
Erin Combs
Madeline Heroff
Shuyu Liao
Michael Lundgren

98 THE FUTURE OF NUCLEAR FUSION: HELIUM-3

Technology

What is the easiest, safest, and most efficient way to acquire Helium-3 for use in nuclear fusion?

We will test multiple ways of extracting and synthesizing helium in a lab. We will demonstrate the most successful method we find using small-scale demonstrations. We will create a new technology designed for the extraction of helium from different locations. We will show how Helium-3 would be utilized as a safe alternative to tritium in nuclear fusion.

Highland High School, Pocatello, Idaho
Seancey Nelson
River Southwick
Kasandra Wielenbeck

99 PROJECT SUSTAIN

Behavior

Can we enhance environmental student learning through games in order to impact their choices later on in life?

Project Sustain is the culmination of a card game and a video game that teach an enhanced version of the environmental aspects of the NGSS standards at early ages. In the video game, students grades K-5 are challenged to build their own city to be both environmentally sustainable and economically feasible. With our card game, preteens are tasked with managing global climate affairs. Players struggle to come out with the highest energy capacity while keeping the global pollution level low and avoiding city-destroying natural disasters. With our implementation of climate change education in the classroom through a fun, simple medium, students have been shown through testing to not only retain a higher quantity of acquired knowledge but also to excitedly reinforce their education in their free time.

Tesla STEM High School, Redmond, Washington

Eli George
Theodor Johansson
Caeli MacLennan
Adrian Pang
Matthew VonAllmen

100 REIMAGINING THE INTERNAL COMBUSTION ENGINE

Technology

How can we improve the efficiency of a standard internal combustion engine with improvements by replacing the camshaft with an electronically actuated pneumatic firing system?

We intend replacing the mechanical component of a standard camshaft with an electronically actuated pneumatic system to eliminate the mechanical loss of kinetic energy and to utilize more accurate electronically calibrated timing.

Interlake High School, Bellevue, Washington

Faris Gulamali
David Hwang
Aman Mohammed
Adeeb Mohammed

101 REMEDIATION OF ALGAL GROWTH FACTORS VIA PERSONAL STORM DRAIN

Design

Can we improve the quality of waterways and reduce algal blooms by reducing the amount of phosphates and other pollutants that come from personal storm drains using a filtering system?

We are retrieving water samples from local storm drains, and testing the pH and phosphate levels. We are also running our water samples through different filtering materials to effectively reduce or eliminate phosphate levels. Furthermore, we are retrieving algae and evaluating the growth difference based on the amount of phosphates.

Henry M. Jackson High School, Mill Creek, Washington

Jose Alvarez
Tabitha Bode
Kaitlin Peli

102 T.E.R.R.A.

Behavior

How does an app-based incentive system affect recycling habits of the participating users?

Terra is an app designed to encourage and record recycling in users aged 12–65 by creating a comprehensive social reward system. The rewards would be coupons and samples from major companies like Coke and Pepsi that would partner with the app in return for free advertising and good publicity. The type of coupons given would be based on the user's recycling history to see which products they use the most. Users compete with each other based on the points they earn through recycling, which are redeemable for rewards. The main display shows the user's profile and points earned, as well as the locations of nearby recycling stations.

Vancouver iTech Preparatory, Vancouver, Washington

Dylan Bartos
Jason Harper
Calleese Henderson
Emily Torjusen

103 BIOMIMICRY—MAKING AN ECO-FRIENDLY HOUSE PAINT THAT MIMICS THE WATER RESISTANCE OF A LEAF

Technology

Can we create an environmentally friendly paint that is dirt and water resistant using biomimicry?

The method we will use to conduct our study is to first make different mixes of paint. We will then test each paint by applying it to a piece of cedar wood and running a mixture of dirt and water over the painted surface once it has dried. After the mixture has run off, and whatever remains on the surface has dried, we will use the tape method to find how many dirt particles were left on the painted surface. The tape method is taking a piece of tape and lightly pressing it onto the surface so it will pick up dirt. Then we will count how many particles of dirt are on the piece of tape.

Camas High School, Camas, Washington

Stephanie McCallum
Ashley Miles
Bailee Thompson

104 OPTIMAL WETLAND

Design

How can we design a wetland for Ellensburg, Washington, to sequester our carbon dioxide emissions?

First we researched the carbon dioxide emissions for our county, along with the methods and practices involved in constructing a wetland. We then looked at our local climate and geography to determine the ideal location to implement a resulting wetland that would sequester our produced greenhouse gas. Our plan incorporated the calculated cost of installation and maintenance, and the long-term benefits of the system.

Ellensburg High School, Ellensburg, Washington

Owen Canterbury
Logan Davis
Star Summer

105 PSE: GREEN POWER

Behavior

How can we promote the usage of green energy power despite the seemingly intangible benefits?

Puget Sound Energy (PSE) in Washington employs many strategies for promoting green energy usage and resource planning. We will work with PSE advisors and workers to collect data and statistics to analyze which method most effectively promotes green energy. After determining the optimal method, we will investigate practical ways to implement that method and influence the general public to convert to green energy.

Interlake High School, Bellevue, Washington

Lukas Corey
Chunyang Ding
Raymond Hsu
Ruhee Wadhwania
Kelly Jiang, Redmond High School (collaborator)

106 WATER OUT OF THIN AIR

Technology

How can we provide clean drinking water through condensation to communities and families who lack easily accessible water sources?

We will research methods of condensing water from the atmosphere, both with and without power. Power would be provided through solar panels or other renewable energy resources so that we will not exchange "oil for water" and so that it would not require any outside energy input. Our primary focus will be this method' ease of distribution—not only will the condenser be affordable, it will also be easily shippable anywhere in the world by conventional mail and delivery. Other considerations will include the filtration of water and the climate of the destination and which renewable resources best fit the location.

Issaquah High School, Issaquah, Washington

Mickee Cheung
Haley King
Josh Zhanson
Austin Zhao

107 SUSTAINABLE DESIGN ON CAMPUS

Design

How can we retrofit our agriculture portable to be the sustainable energy beacon for the campus?

We are going to research the cost and effectiveness of various types of sustainable energy sources including solar panels, wind turbines, and also incorporating our rain turbine prototype from our technology group. Once research has concluded, we will draw up a plan of how to retrofit and then proceed with the retrofit taking care to gather data on how much energy is consumed before the retrofit and how much after.

Eatonville High School, Eatonville, Washington

Madeline Frey
Kailyn Hall
Kayla Maas

108 HARNESSING AND CONVERTING EXTRANEOUS RADIO WAVES INTO USEABLE ELECTRICITY

Technology

By changing the design of our previous device, can we create an apparatus that can catch radio waves and turn them into electricity?

We first improved the project from last year by increasing the surface area of the antenna plate, changing the design of the antenna, and winding the copper in a different way. Then we tested our device at five locations, each completely different from another, at various times of day and checked the amount of volts we got. We proved our hypothesis correct and solved our question. Yes, we were able to harness extraneous radio waves and turn them into quantifiable electricity. We found that we were able to get considerable more voltage using this design than last year's version.

Henry M. Jackson High School, Mill Creek, Washington

Jacqueline Nguyen
Noah Parker
Afomia Seleshi

109 SUSTAINABLE RETROFITTING APP

Behavior

How can a mobile app educate users about the personal incentives to sustainably retrofit a residential space, while providing guidance to accomplish feasible goals?

We will develop an iOS app that takes user input about a residential space and generates home-improvement project recommendations that would suit the user's budget restrictions, time requirements, etc. Each project will fall into one of the four Built Green home-refit categories: site and water, green materials, indoor air quality, or energy. Since each project will impact one of these areas, each completed project will earn a specified number of points toward a certification goal for the home. After reaching the certification goal in all four categories, the user will be recommended to either fill out the Built Green checklist or formally audit their home to receive certification, which can significantly increase the home's value.

Issaquah High School, Issaquah, Washington

Daniel Barnett
Ben Barnett
Eleanor Grudin
Anne Robertson

110 THE USE OF A WIND TURBINE AS A REGENERATIVE BRAKE FOR TRADITIONAL COMBUSTION ENGINE VEHICLES

Design

Can a wind turbine act as a regenerative brake on traditional combustion engine vehicles, providing the consumer with a cheaper alternative to purchasing a hybrid car?

The design uses a wind turbine to capture some of the otherwise lost kinetic energy during braking. The captured energy is then used to charge the vehicle's battery, potentially lightening the load of the alternator. It could be an aftermarket addition to any existing combustion vehicle. To test this design a bicycle was converted into a wind turbine and placed on top of a 1999 Subaru Legacy Outback. The results provided evidence that a wind turbine could be used as a regenerative brake for a combustion engine vehicle. It was calculated that in the current fuel economy an optimized wind turbine regenerative brake could save the consumer $0.26 a day in gas money, while reducing the overall emissions of the vehicle.

Sentinel High School, Missoula, Montana

Parker Blennek
Thomas Keith
Kasey Leavell
Sydney Pasternek
Taylor Schaffer

111 HYDROELECTRIC ENGINE

Technology

Will there be an easier way to produce electricity using water for water deprived areas?

Make a turbine using spoons and a cork. Put a wooden dowel through the cork and make sure it also goes through the bin. Prepare a cardboard model about 3 cm by 16 cm and fold it in half. Using enameled magnet wire, make 4 coils using 200 wraps around the cardboard model. Slip the coils off and remove the enamel insulation from the ends of the coil. Lay the coils on the disk and make they're clockwise and counterclockwise. Glue them onto the disk and connect the coil's ends together. Glue the disk on the side of the bin. Glue magnets onto another disk, making them have opposite poles. Make sure they are not touching the wires but they are fairly close to them.

TAF Academy, Kent, Washington

Maurice Brightmon
Christopher Calimlim
Malcom Crenshaw
Austin Dezeeuw
Pablo Rodriguez

112 ELIMINATING SOUND POLLUTION FROM RAINFALL ON AN ECOHOME ROOF

Design

Can we design a rainwater garden that can maximize water delivery while also designing a rainwater roof that will minimize sound pollution?

We will be exploring different types of roofing materials and roofing designs to minimize rainwater noise. After we choose these materials, we will design a rain garden that will be hydrated primarily from the water this roof is designed to collect.

Henry Foss High School, Tacoma, Washington

Linh Le
Eilish McLean
Michaela Phillips
John Waller

113 THE BIOFUELTURE: AQUAPONICS

Biofuels

As gas prices dip below $3, will biofuels still be an economically viable option for fueling our lives? If so, how would this be possible?

We will be creating and testing a small-scale aquaponics system to simulate an industrial size aquaponics reservoir that will then be routed into powering electric cars and feed into the homes when that car is charging, or be rerouted into the electrical grid work of houses (past the transformer boxes in neighborhoods). Our final step is to compare aquaponics biofuel to the other types of biofuels to test efficacy of this particular source of biofuels.

Tesla STEM High School, Redmond, Washington

Saakshi Dulani
Daaniya Iyaz
Meena Meyyappan
Reksha Rathnam
Warisha Soomro

114 RE-WASH INTERNATIONAL

Technology

How can we provide clean, sterile, temperature-controllable water to families in third-world countries with little-to-no power grids using simple, effective mechanisms that can easily be repaired?

Water is filtered through the use of existing basic filtration methods, put to use on the scale of a 55-gallon barrel. Two barrels are used, one containing filtered water and the other containing layers of gravel, fine sand, and activated charcoal. The filtration barrel is mounted on top of the containment barrel. It is then sterilized with an easily applied dosage from a solution of diluted chlorine and water. Water can then be warmed through a solar water-heating apparatus. All modules are made using off-the-shelf parts and can be relatively easily repaired. This system takes no outside energy, therefore is perfect for the countries it would serve.

Vision Charter School, Caldwell, Idaho

Isaiah LaMasters
Tanner Leavitt
Hannah Martinez-Samuelson
Paul Riebe
Caleb Stucki

116 H.E.I.D.

Technology

Is it possible to save time and energy when heating your car and defrosting the windshield in the morning?

We are planning on putting a heating element in the heaters of cars to transfer heat to the air faster.

Pullman Christian School, Pullman, Washington

Christian Hancock
Dru Holmbo
Duha Ikiz
Samuel Lindstrom
Duncan Mitchell

117 DON'T THROW IT—GROW IT

Behavior

Can we change the behavior of a school district or municipality from their practice of doing basic recycling of paper waste into an effective revenue-generating myco-remediation growing system?

By remediating waste paper with energy-efficient mycological processes, we will demonstrate how waste can be turned into valuable commodities that school districts and cities can use as a revenue source. We will show how our system is sustainable. We will propose a business plan and system model for the full scale remediation of paper waste.

Hudson's Bay High School, Vancouver, Washington

Brittney Hauff
Cedric Hitzeman

118 THE LITTLE BIOENGINE THAT COULD

Technology

Is the use of the biofuel coconut oil an effective alternative to the use of traditional gas in a simple engine?

To complete our task we will use the engine from a lawnmower, and the coconut oil fuel alternative produced from a fellow group. We will test the engine, altered to support the biofuel, along with the biofuel itself to create a running model. The purpose of this is to display how effective and reliable the clean renewable fuel is, compared to what we use daily, and perhaps determine that coconut biofuel is an alternative to traditional fuels.

Vision Charter School, Caldwell, Idaho

Hunter Allred
Sahil Banga
Amy Hatsedakis
John Newton
Cody Wells

120 SOP: SWITCHING OFF THE POWER!

Behavior

What incentives can we use to encourage more consumers to use energy-conserve switches by illustrating the resulting energy and cost savings?

Through the use of general energy consumption surveys and at-home trials, we will determine the public knowledge of energy-conserve switches, the general opinion toward them, and the reasons people are apprehensive about purchasing them. We will also analyze the energy and cost savings associated with using energy-conserve switches on various household appliances and electronics. Through these methods, we will propose ways to increase the use of energy-conserve switches through marketing plans, tax breaks, and/or legislation.

Vision Charter School, Caldwell, Idaho

Madalyn Leavitt
Brittany Messick
Jessica Patton
Aureona Thomas

121 RAIN WHEEL

Technology

How can we create clean reusable energy from rain?

Create a slot in the center of the widest spot of a downspout. Use a heat gun to open the flaps. Drill a 5/16 hole on both sides of the downspout's flaps. Mount 2 nylon bearings on each side of the downspout. Tightly wrap a coil on the copper coiling base with copper wiring. Assemble the shaft by putting all nuts, bolts, and washers into place. Place magnets on shaft closest to the downspout, put tape around the magnets. Place copper coil on shaft over the magnets. Make sure magnets are in exact center of the copper holder.

TAF Academy, Kent, Washington

Jean-Claude Cisse
Drake McCune
Javier Moreno-Colin
Orion Parmer
Christopher Williams

122 WASTE NOT, WANT NOT

Behavior

How can we decrease the amount of compostable waste from school lunch rooms in light of the new guidelines for school lunches?

Food waste has been a major yet not well-known problem, but it is easily preventable. It harms our atmosphere, being a significant producer of green-house gasses. Food waste costs the United States $165 billion dollars a year, enough to feed those who are impoverished. Because of the "you must take one vegetable" rule enforced in high schools across the district, quickly compostable foods are being thrown away each day. We decided on composting in our school because educating students was not enough. A composting barrel is the fastest and cleanest method. We will introduce posters around the school informing students and staff of the harmful effects of food waste. Then we will announce the introduction of separate trash bins at lunches for leftover items available for compost.

Henry Foss High School, Tacoma, Washington

Hallie Bader
Dov Guy
Henry Hua
Hyunsung Kim

123 BUILDING IN GREEN

Design

How do we use sustainable building techniques in schools to solve classic architectural concerns while allowing students to interact with the building features?

We came up with a list of ideas that we wanted to incorporate into our school's design. We emphasized water sustainability through our three primary goals of flexibility, functionality, and fluidity. We created a three-dimensional model of our design after creating floor plans and analyzing the actual site. After creating a PowerPoint presentation of our final concept, we presented it to a board of professional architects.

Camas High School, Camas, Washington

Yu Ju Fang
Esther Kwon

124 DIY SOLAR POWERED DEVICE CHARGER

Technology

Can you build a solar charger for less than $5?

Research and buy materials online and build a prototype.

Liberty Bell High School, Winthrop, Washington

Logan Butler
Hannah Weymuller

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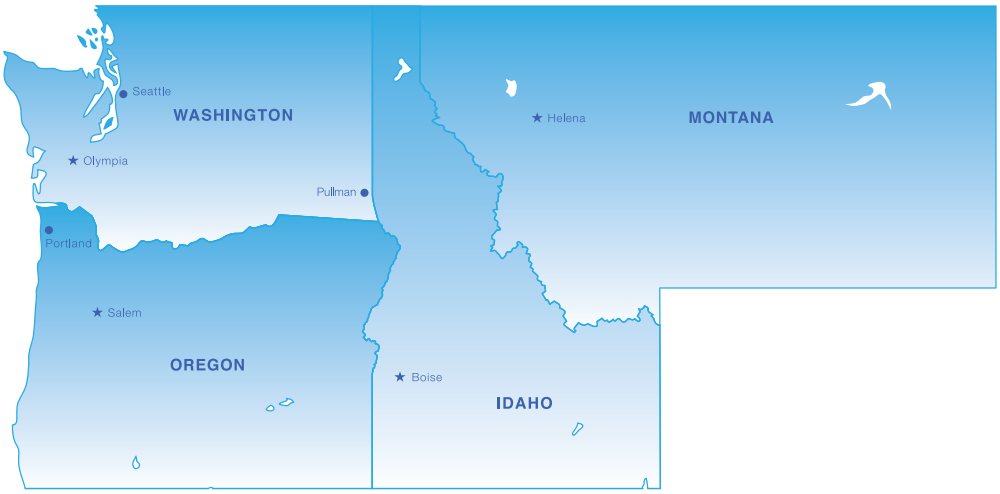
• Tri-Tech Skills Center, Kennewick, Wash.	93, 21
• Vancouver iTech Preparatory, Vancouver, Wash.	102, 29, 91, 40
• Vision Charter School, Caldwell, Idaho	120, 96, 86, 52, 43, 42, 114, 118
• Yelm Extension School, Yelm, Wash.	48

IMAGINE TOMORROW
CONGRATULATES THE FOLLOWING HIGH SCHOOLS FOR THEIR INVOLVEMENT AND INNOVATION.



Idaho

Capital High School, Boise
Highland High School, Pocatello*
Vision Charter School, Caldwell

Washington

Academy of Construction and Engineering-Marysville Getchell High School, Marysville
Ballard High School, Seattle
Bonney Lake High School, Bonney Lake
Camas High School, Camas
Colville High School, Colville
Eatonville High School, Eatonville*
Ellensburg High School, Ellensburg
Glacier Peak High School, Snohomish
Henry Foss High School, Tacoma
Henry M. Jackson High School, Mill Creek
Hudson's Bay High School, Vancouver
Interlake High School, Bellevue
International Community School, Kirkland
Issaquah High School, Issaquah

Montana

Sentinel High School, Missoula

Oregon

Kings Valley Charter School, Philomath

Klahowya Secondary School, Silverdale
Lake Roosevelt High School, Coulee Dam
Lake Stevens Senior High School, Lake Stevens
Liberty Bell High School, Winthrop
Olympia Regional Learning Academy, Olympia*
Pullman Christian School, Pullman
Pullman High School, Pullman
Quincy High School, Quincy
Skyview High School, Vancouver*
Tacoma School of the Arts, Tacoma*
TAF Academy, Kent
Tesla STEM High School, Redmond
Tri-Tech Skills Center, Kennewick
Vancouver iTech Preparatory, Vancouver
Yelm Extension School, Yelm

* New to the competition

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